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09/351,892	07/13/1999	ELWIN M. BEATY	2371	1396

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EXAMINER
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ART UNIT	PAPER NUMBER
2621	7

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/351,892	Applicant(s) Elwin M. Beaty
	Examiner Sheela Chawan	Art Unit 2621

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☐ Responsive to communication(s) filed on _____.

2a) ☐ This action is **FINAL.** 2b) ☒ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) 1-32 is/are pending in the application.

4a) Of the above, claim(s) _____ is/are withdrawn from consideration.

5) ☐ Claim(s) _____ is/are allowed.

6) ☒ Claim(s) 1-29 is/are rejected.

7) ☒ Claim(s) 30-32 is/are objected to.

8) ☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

9) ☐ The specification is objected to by the Examiner.

10) ☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved.

12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

13) ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

a) ☐ All b) ☐ Some* c) ☐ None of:

1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

*See the attached detailed Office action for a list of the certified copies not received.

14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

15) ☒ Notice of References Cited (PTO-892)
16) ☒ Notice of Draftsperson's Patent Drawing Review (PTO-948)
17) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s). 4
18) ☐ Interview Summary (PTO-413) Paper No(s). _____
19) ☐ Notice of Informal Patent Application (PTO-152)
20) ☐ Other:

DETAILED ACTION

Drawings

1. The drawings are objected to because of draftsperson's remarks (see attached PTO-948). Correction is required.

See MPEP 608.02(d) . Any structural details that is essential for a proper understanding of the disclosed invention should be shown in the drawing . MPEP 608.02(d). Correction is required

Allowable Subject Matter

2. Claims 30-32 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claim Rejections - 35 U.S.C. § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was

commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103© and potential 35 U.S.C. 102(f) or (g) prior art under 35 U.S.C. 103(a).

4. Claims 1,4,12-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Suzuki et al., (US.6,307, 210), in view of Nayar (US.4,893,183) .

As per claim 1, Suzuki teaches an apparatus for three dimensional inspection of an electronic part, wherein the apparatus is calibrated using a precision pattern mask with dot patterns deposited on a calibration transparent reticle, the apparatus for three dimensional inspection of an electronic part comprising:

(a) a camera (fig 2a 1, column 2, line 62) and an illuminator for imaging the electronic part (column 2, line 65, column 9, lines 52-56, fig 14, 20 and 22) , the camera being positioned to obtain a first view of the electronic part (note, fig 2a element 1 camera taking image of first view of electronic part is considered to be upper surface image of an IC package to be imaged) ;

(b) a means for light reflection (fig 14, 20 and 22), positioned to reflect a different view of the electronic part into the camera, wherein the camera provides an image of the electronic part having differing views (column 4, lines 1-27) ; and

Although, Suzuki discloses device for imaging object to be inspected and device for inspecting semiconductor package, but fails to specifically mention about calculating a different

views of the image using three - dimensional position of at least one portion of the electronic part . However, Nayar discloses robotic vision system relates to three-dimensional robotic vision system one camera and at least two elements which reflect light from objects to be located into the camera wherein computer calculates with respect to a given reflection in one of the n spheres the epipolar curve for the reflection in each of the other spheres in order to determine the reflection from each sphere and determine the location of the object associated with the reflections (fig 3, column 3, lines 18- 57), as shown by Nayar the use of calculating a different views of the image using three - dimensional position ... , because the invention relates to a three-dimensional robotic vision system that utilizes one camera and at least two elements which reflect light from objects to be located into the camera in which three-dimensional vision systems has created considerable interest in the development of high quality depth sensors (column 1, lines 20- 39).

Therefore, it would have been obvious to one with ordinary skill in the art at the time of invention that by incorporate Nayar 's system by calculating a different views of the image using three - dimensional position ... , of Suzuki, because, one with ordinary skill in the art would realize that the invention relates to a three-dimensional robotic vision system that utilizes one camera and at least two elements which reflect light from objects to be located into the camera in which three-dimensional vision systems has created considerable interest in the development of high quality depth sensors, as suggested by Nayar at (column 1, lines 20- 39).

As per claim 4, Suzuki teaches the apparatus of claim 1 wherein the means for light reflection further comprises a prism (column 8, lines 65- 67).

As per claim 12, Suzuki teaches the apparatus of claim 1 wherein a maximum depth of focus of a side perspective view (column 2, lines 35-39) allows for a fixed focus system to inspect larger electronic parts (column 3, lines 6-18) , with one perspective view imaging one portion of the electronic part and a second perspective view imaging a second portion of the electronic part (column 3, lines 6-18, column 4, lines 1 - 30) .

As per claim 13, Suzuki teaches the apparatus of claim 1 wherein a maximum depth of focus of a side perspective view includes an area of the electronic part including a center row of balls (column 13, lines 53-68, column 14, lines 1-7) .

As per claim 14, Suzuki teaches the apparatus of claim 13 wherein all of the balls on the electronic part are in focus resulting in two perspective views for each ball (column 14, lines 1-7).

As per claim 15, Suzuki teaches the apparatus of claim 1 further comprising a means for inspecting gullwing and J lead devices (column 6, lines 48-51) .

As per claim 16, Suzuki teaches a method for three dimensional inspection of a lead on a part, the method comprising the steps of:

(a) using a camera to receive an image of the lead (fig 2(a)) ;

(b)transmitting (column 2, lines 50-60, column 3, lines 49-64) the image of the lead to a frame grabber (column 7, lines 64-67) ;

© providing fixed optical elements to obtain a side perspective view of the lead (column 4, lines 20-26) ;

(d) transmitting the side perspective view of the lead to the frame grabber (column 2, lines 50-60, column 3, lines 49-64) ;

(e) operating a processor (CCD has a processor , column 7, lines 50-53) to send a command to the frame grabber to acquire images of pixel values from the camera (column 7, lines 55-63) ; and

(f)processing the pixel values with the processor to calculate a three dimensional position of the lead (column 14, lines 1-7).

As per claim 17, Suzuki teaches the method of claim 16 wherein the step of processing the pixel values further comprises determining state values from the part itself (column 12, lines 20-67) .

As per claim 18, Nayar teaches the method of claim 16 wherein the lead is a curved surface lead (column 3, lines 40- 45) .

As per claim 19, Suzuki teaches the method of claim 16 wherein the lead is a ball (column 13, lines 59-67).

As per claim 20, Suzuki teaches the method of claim 16 wherein the part is a ball grid array (column 13, lines 53-67).

As per claim 21, Nayar teaches the method of claim 16 wherein the processor processes the pixel values to find a rotation, an X placement value and a Y placement value of the part

relative to world X and Y coordinates by finding points on four sides of the part (note fig 3, transformation between the world and image, column 5, lines 14- 47) .

As per claim 22, Nayar teaches the method of claim 21 further comprising the steps of:

(a) using a part definition file that contains measurement values for an ideal part (note, world coordination , column 4, lines 41-51) ;

(b) calculating an expected position for each lead (note, lead is a ball or sphere) of the part for a bottom view (camera observe the surface of the spheres s), using the measurement values from the part definition file and the X placement value and Y placement value (column 5, lines 14-47) .

As per claim 23, Nayar teaches the method of claim 16 further comprising the step of using a search procedure on the image to locate the lead (column 8, lines 1-9) .

As per claim 24, Nayar teaches the method of claim 16 further comprising the step using a subpixel edge detection method to locate a reference point on each lead (column 5, lines 48-59)

As per claim 25, Nayar teaches the method of claim 16 further comprising the step of determining a lead center (note, lead is considered to be a ball or sphere) location and a lead diameter in pixels and storing (column 4, lines 18-26), the lead center location and lead diameter in memory (column 8, lines 34-46) .

As per claim 26, Suzuki teaches the method of claim 25 further comprising the step of calculating an expected position of a center of each lead in the side perspective view in the image

using a known position of the side perspective view from calibration (column 3, lines 40- 64, column 4, lines 41-68) .

As per claim 27, Nayar teaches the method of claim 25 further comprising the step of converting the pixel values into world locations by using pixel values and parameters determined during calibration wherein the world locations represent physical locations of the lead with respect to world coordinates defined during calibration (column 4, lines 41-68, column 5, lines 14-59) .

As per claim 28, Nayar teaches the method of claim 27 wherein a Z height of each lead is calculated in world coordinates in pixel values by combining a location of a center of a lead from a bottom view with a reference point of the same lead from a side perspective view (column 4, lines 52- 67, column 5, lines 14- 60).

As per claim 29, Nayar teaches the method of claim 28 further comprising the step of converting the world coordinates to part values using a rotation, X placement value and Y placement value to define part coordinates for an ideal part where the part values represent physical dimensions of the lead including lead diameter, lead center location in X part and Y part coordinates and lead height in Z world coordinates (column 4, lines 52- 67, column 5, lines 14- 60).

5. Claims 2, 3, 5-10, are rejected under 35 U.S.C. 103(a) as being unpatentable over Suzuki et al., (US.6,307, 210), in view of Nayar (US.4,893,183), as applied to the above claims 1, 4, 12-29, and further in view of King et al., (US.6, 236, 747) .

Regarding claim 2, Suzuki discloses device for imaging object to be inspected and device for inspecting semiconductor package, but fails to specifically mention about illuminator comprises a ring light . However, King discloses system and method for image subtraction for ball and bumped grid array inspection where the ring illumination apparatus 20 includes a substantially ring -shaped light source 24 that generates light beams and directs the light beams into the field of view on the article , column 5, lines 41- 58), as shown by King the use of illuminator comprises a ring light because the system detects quickly and accurately detects absence/presence of the illuminated reflective elements , determines their position , and measures the size and shape , e.g. the diameter and circularity of any protruding object, if desired (column 3, lines 11- 15) .

Therefore, it would have been obvious to one with ordinary skill in the art at the time of invention that by incorporate King 's system where illuminator comprises a ring light of Suzuki, because, one with ordinary skill in the art would realize that this system detects quickly and accurately detects absence/presence of the illuminated reflective elements , determines their position , and measures the size and shape , e.g. the diameter and circularity of any protruding object if desired , as suggested by King at (column 3, lines 11- 15) .

As per claim 3, King teaches the apparatus of claim 1 wherein the means for light reflection further comprises a mirror (column 9, lines 54- 58) .

As per claim 5, King teaches the apparatus of claim 1 wherein the means for light reflection further comprises a curved mirror (column 9, lines 55-58) .

As per claim 6, King teaches the apparatus of claim 1 wherein the electronic part further comprises a ball grid array (column 5, lines 27-30) .

As per claim 7, King teaches the apparatus of claim 6 wherein the electronic part further comprises balls on a wafer (column 5, lines 27-30) .

As per claim 8, King teaches the apparatus of claim 6 wherein the electronic part further comprises balls on a die (column 10, lines 25-29) .

As per claim 9, King teaches the apparatus of claim 1 wherein the means for imaging provides the image to a frame grabber board (note, CCD is considered to be frame grabber , column 5, lines 59-68) .

As per claim 10, King teaches the apparatus of claim 9 wherein the frame grabber board provides an image data output to a processor to perform a three dimensional inspection of a part (column 12, lines 45 - 67, column 13, lines 1-5) .

As per claim 11, King teaches the apparatus of claim 1 further comprising a nonlinear optical element to magnify the image in one dimension (column 15, lines 26-35).

Other prior art cited

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Maali et al., (US.5, 694,482) discloses system and method for locating solder bumps on semiconductor chips or chip carrires .

Buckley et al., (US. 6, 064, 759) discloses computer aided inspection machine.

Collet-Beillon (US. 5,574, 801) discloses method of inspecting an array of solder ball connections of an integrated circuit module.

Stern et al., (US. 5, 648, 853) discloses system for inspection pin grid arrays.

Contact Information

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Sheela Chawan whose telephone number is (703) 305-4876.

If attempts to reach the examiner on Monday through Thrusday from 8:30 a.m. to 5: 00 p.m. by telephone are unsuccessful, the examiner's supervisor, Leo Boudreau , can be reached at (703) 305- 4706.

Any response to this action should be mailed to:

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or faxed to:

(703) 872 - 9314, (for formal communications intended for entry)

Or: Any inquiry of a general nature or relating to the status of this application should be directed to the Group Receptionist whose telephone number is (703)305-3900.

SLC

Sheela Chawan
Patent Examiner
Group Art Unit 2621
April 2, 2002

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